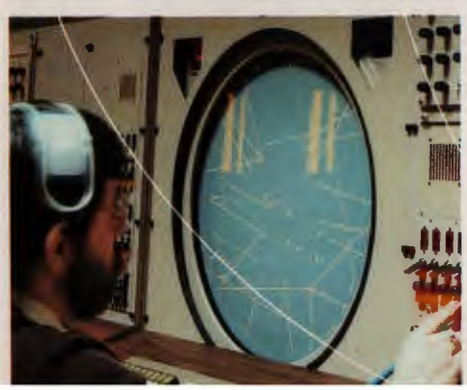
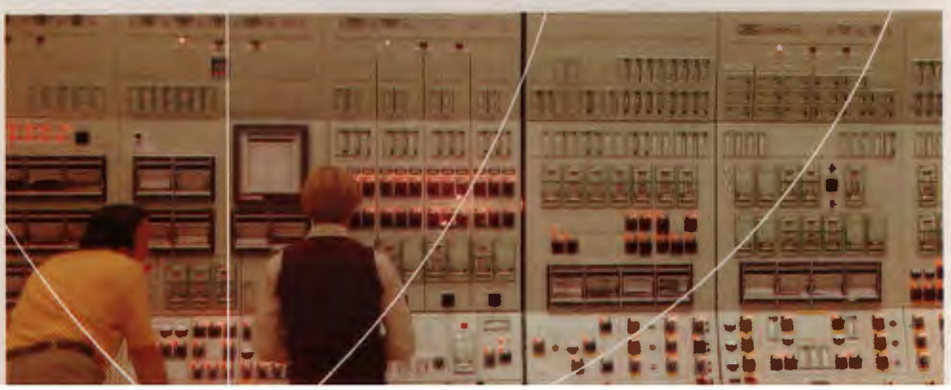
CAE ELECTRONICS LTD.

A Leader in Advanced Technology





The Story of CAE

Founded in 1947 as Canadian Aviation Electronics Ltd., CAE was initially engaged in the repair and overhaul of electronic and electro-mechanical equipment for the military. Within a short time, CAE began to design, develop and produce flight, radar and weapons simulators and avionics equipment for Canadian defense requirements. The technological skills and facilities developed during the production of 77 military simulators for 10 western nations led CAE into commercial fields.

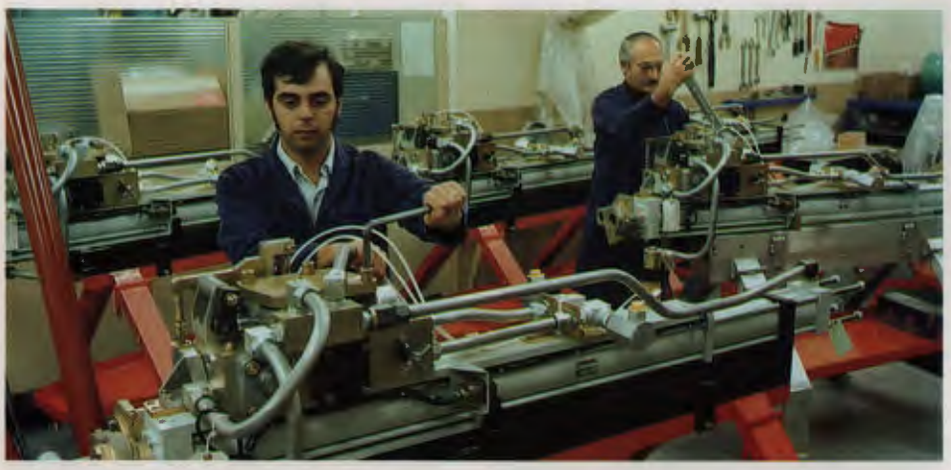
CAE Electronics Ltd. today...
The company is regarded as one of the world leaders in the design and production of sophisticated commercial and military aircraft flight simulators and of airborne magnetic anomaly detection equipment. Applying this expertise to other fields, CAE has also become a major producer of computer-based systems for demanding applications — in electrical power generation and transmission, in oil production, in gas transmission, in air traffic control and in space.

CAE Electronics Ltd. is a subsidiary of CAE Industries Ltd. of Toronto, a Canadian-owned holding and management company employing more than 4,200 people in diverse enterprises across Canada and in Western Europe.

CAE Facilities

CAE's 30,000 sq. meter integrated engineering and manufacturing complex, located near Montreal, encompasses design, engineering and test facilities; machine shop, fabrication, welding, plating and painting shops, as well as in-house facilities for making printed circuit boards. CAE also has its own clean room laboratories for mechanical and electrical calibration directly traceable to government standards. CAE Electronics employs 1,700 people, more than 600 of whom are highly qualified engineers and scientists.

With some of the company's products being manufactured to MIL-spec requirements, a sophisticated Quality Assurance program has been developed to ensure that the highest standards of workmanship are met in all product areas.



Left: *Skilled technicians assemble hydraulic jacks for a simulator six-degree of freedom motion system.*

Above, left to right:
Computerized mechanical measuring equipment provides high volume, high accuracy inspection of machined components.

One of the many numerically controlled machine tools in CAE's versatile machine shop.

CAE's automated drafting system saves hours of repetitive work.

Left: *In controlled-environment clean rooms over 3000 pieces of CAE test equipment receive scheduled calibration, aircraft instruments are repaired, and elements of the NASA space shuttle arm*

CAE in Flight Simulators

CAE is one of the world's leaders in the design and manufacture of flight simulators — with British Airways, KLM, Swissair, United and Air Canada among our repeat customers. CAE produces simulators for all of the jet aircraft types made by Airbus, Boeing, Lockheed and McDonnell Douglas.

CAE has introduced many innovations in simulation technology, such as the hydrostatic six-degree of freedom motion system, the use of general purpose computers, and CRT-based instructor's facilities. CAE simulators faithfully reproduce aircraft performance in all flight regimes and, in particular, the critical landing phase.

Simulators for Fixed Wing Aircraft

Digital flight simulators have been made by CAE for the A-300, B-727, B-737, B-747, DC-8, DC-9, DC-10, L-1011, F-28, CL-600 and for the new generation A-310, B-757 and B-767 coming into service with the world's leading airlines.

A wide range of simulators has also been supplied to different countries for various types of military aircraft, including tactical jet fighters, jet trainers, antisubmarine patrol aircraft and transports. Various simulator designs are available to suit specific applications, each comprising a flight compartment with instructor's station, a motion system on which the flight compartment is mounted, a computer complex and a visual system.

Above, left to right:

DC-9-80, B-747, B-727 and DC-10 simulators (left to right) *undergoing final tests and acceptance in one of CAE's high-bay test areas.*

Faithful cockpit reproduction, utilizing actual aircraft instruments, provides pilots with a familiar and factual environment.

Complex simulators, designed by CAE, are being produced for the tri-nation multi-role combat aircraft (MRCA) "Tornado".

Left: *A CAE-built B-727 simulator located at TWA's Kansas City training base.*

Helicopter Simulators

CAE has an established reputation in the specialized field of helicopter simulation, having produced flight and tactical simulators for Agusta, Bell, Boeing-Vertol, Sikorsky and Westland helicopters. The simulation requirements for helicopter pilot training differ considerably from fixed wing aircraft, particularly in the need for motion cues that accurately reflect rotor vibration and the demand for low level visual system effects in hover and landing manoeuvers.

CAE has designed and built a number of flight and tactical simulators for helicopters, including the Agusta AB-205 and AB-212, Bell UH-1D, Boeing-Vertol CH-47, Sikorsky CH-53 and Westland Sea King MK41.

CAE pioneered the use of CRTs to simplify the instructor's station.

Right: *The Sea King MK41 helicopter simulator, built for the German Navy, undergoing final tests at CAE.*

Far right, top: *Training of the Sea King flight crew and search and rescue operators is conducted from this off-board instructors' facility.*

Far right, center: *This CH-47 "Chinook" simulator utilizes a sophisticated TV/model visual system to provide effective pilot training.*

Right: *A view through the windscreen of the CH-47 "Chinook" simulator shows the realistic detail achieved in the picture transmission of the terrain model.*

Far right: *This CH-53 simulator, built for the German Army, has two cabs sharing a common computer and instructor's facility.*

CAE in Avionics

CAE is a world leader in the development and manufacturing of airborne Magnetic Anomaly Detection (MAD) systems used in anti-submarine warfare (ASW) and geophysical exploration.

CAE has developed a caesium magnetometer system proven to be the most sensitive MAD detection equipment available.

This highly sensitive magnetometer, usually mounted in a "stinger" at the rear of the aircraft, can measure changes in the earth's magnetic field as small as one part in five million and has the best demonstrated submarine detection capability.

A CAE magnetometer is tested on a Canadian Armed Forces helicopter for boom or towed deployment.

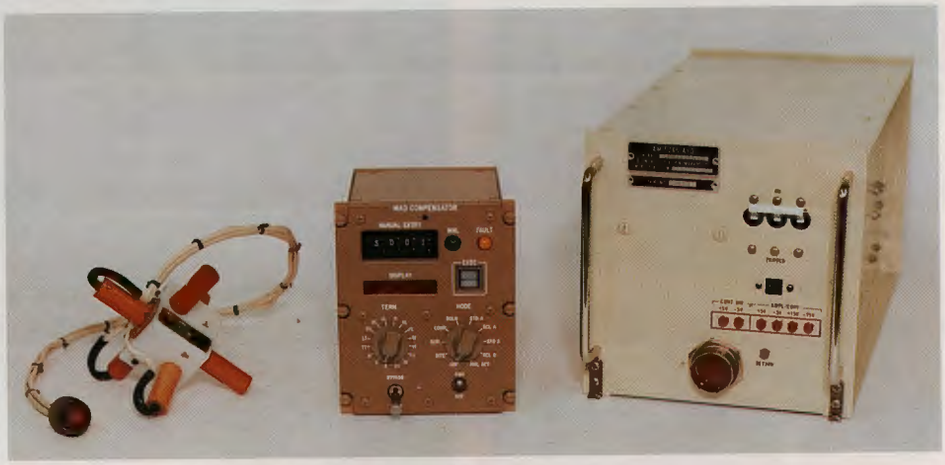
The AN/ASQ-502 Detecting Head, Control Unit and Amplifier, used on the Aurora, provide a substantial improvement in sensitivity and reliability.

To utilize the sensitivity of the MAD detector, CAE has developed a Fully Automatic Compensation System (FACS) for aircraft manoeuver-related magnetic interference fields.

The FACS system, which is compatible with all magnetometer systems now in use, employs a micro-computer to perform all necessary calculations and to generate the required compensation information.

Airborne MAD equipment has been supplied by CAE to the defense forces of the United States, United Kingdom, Netherlands, Australia, Canada, Iran and Japan.

Canada's CP-140 Aurora, the world's most advanced ASW and coastal patrol aircraft, is equipped with a new CAE magnetometer and microprocessor-based automatic compensator system.



CAE's magnetic compensator is the standard used on most of the western world's ASW patrol aircraft.

CAE in Nuclear Power

Training Simulators

The essential purpose of a power plant simulator is to provide power station operating personnel with an in-depth knowledge of the purpose, layout and operation of all controls, monitoring devices, indicators and annunciators of the actual power station control equipment. In developing a faithful and highly efficient power plant simulator, CAE has applied much of its technological expertise gained in the flight simulator field.

The simulator trains operators to develop experience in responding to all normal, abnormal and emergency conditions and to learn required operating procedures and techniques.

From his control console, the instructor can set up lessons on the simulator, monitor trainee progress and momentarily freeze action to provide guidance to a student.

Left: *Standard mini-computers, programmed by CAE, calculate all the plant processes and provide realistic outputs to control panel instruments and indicators.*

Above: *An exact replica of a control room at the Pickering Generating Station, this CAE-built simulator provides comprehensive training for Ontario Hydro station operators.*

Plant Monitoring and Control

In nuclear power generating stations, CAE's Digital Computer Controller systems are used to monitor and control all major reactor and power plant functions. The generation of power is fully dependent on the continuous operation of the station's computer control system. The nuclear power industry requires equipment which provides the necessary reliability in both the operational and safety aspects of the system. The proven design and high availability of CAE's equipment has earned the approval of the Canadian Atomic Energy Control Board and regulatory authorities of other countries. An important feature of the CAE system is the full colour operator display which facilitates the ease of assimilation of all operational parameters of the power plant. The system also has seismic qualification, a potentially important safety aspect depending on the location of the plant.

Coloured CRT displays provide power station operators with a variety of operational status reports and trend analyses.

The CRT monitors of the CAE Digital Computer Controller system are a prominent feature of the control room of Hydro Quebec's Gentilly II nuclear generating station.

A CAE Digital Computer Controller system under test at AECL for the Wolsung CANDU reactor in Korea.

CAE in Electrical Power

In the electrical power field, CAE's Supervisory Control and Data Acquisition (SCADA) systems are used to monitor and control complex power transmission networks from generation to distribution substations. In this application, as in the nuclear power field, an extremely high degree of reliability is required to avoid costly power failures. CAE has installed equipment capable of meeting the high performance standards in the vigorous electrical environmental conditions associated with high voltage transmission.

A CAE Data Acquisition and Control System (DACS) enables power companies to be constantly aware of transmission network status and, in addition, predict situations where remedial action can be taken to prevent potential transmission problems.

Right: *CAE data acquisition and control systems and remote terminal units have been designed to operate reliably in the 735 kV substations of Hydro Quebec.*

Below: *A CAE-designed system supervises and controls the high power laboratory in the Institut recherche de l'Hydro-Québec.*

Bottom, left: *A CAE DACS system is installed in the Coleson Cove fossil-fired generating station in New Brunswick, Canada.*

Bottom, right: *A CAE SCADA system monitors and controls the generation and transmission of power in Hydro Quebec's massive James Bay energy project.*

CAE in Oil and Gas

The application of CAE's supervisory control systems — essentially a computer center with remote terminals in the oil fields — allows the oil field operator to improve wellhead productivity by monitoring and recording daily production and storing this data on magnetic discs.
Production trends in individual oil wells can be readily identified by the control system.
Similar CAE-built systems are also used to manage complete oil and gas pipeline networks where remote terminals linked to a central control station monitor all stages of transmission.

An essential requirement in these applications is the ability of CAE's equipment to perform reliably and to withstand frequently severe climatic and environmental conditions in isolated areas.

One of the early pumps used in Getty Oil's Kern River Field in California where a CAE computer system now aids in maintaining a high level of production.

Below: *CAE remote terminal units operate continuously in non-air-conditioned enclosures in California where the temperature often reaches a desert-like 50 degrees C.*

Bottom: *Imperial Oil's unattended DACS system, supplied by CAE, monitors environmental conditions on remote Arctic ice fields.*

CAE in Air Traffic Control

Air traffic control systems have been a natural evolution for CAE Electronics. The company's growing skills and flexibility in aviation electronics has led it through several generations of computer technology. CAE has successfully applied this experience in the development of its "JETS" joint enroute/terminal data processing and display system for air traffic control.

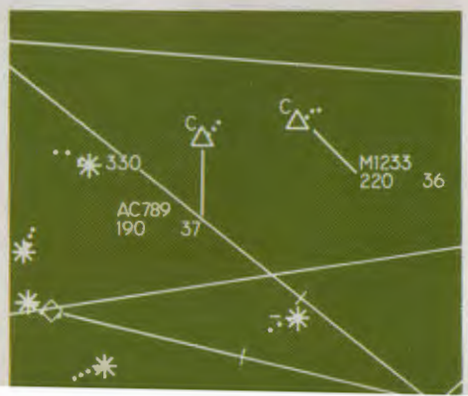
JETS has been conceived and designed to provide display information and control, consistent with the air traffic control demands of today and tomorrow.

A singular feature of the CAE JETS concept is the flexibility in system design to meet both customer and system requirements and to cost-effectively handle light or heavy traffic loads.

Ultimate capacity is in no way limited as the system has the flexibility to meet the needs of future system enhancements.

Modularity permits quick replacement for maintenance and high system reliability.

The controller has the capability to tailor the information appearing on the bright display to his requirements.



Concise information on each aircraft is clearly displayed for the controller.

CAE in Space

The Space Shuttle, developed in the U.S.A. by NASA, is a unique reusable cargo-carrying combination spacecraft-aircraft that can transport weather and communication satellites into space or serve as an earth-orbiting laboratory. An articulated Manipulator Arm with a 14-meter reach releases satellites into orbit, or retrieves them for repair in space or return to earth.

CAE is part of a Canadian consortium responsible for developing and manufacturing the complete Manipulator Arm system. CAE has designed and is manufacturing the display and control panel plus the rotational and translation hand controls that operate the manipulator itself.

CAE has also designed and developed the simulation subsystem which is used as a design tool to test hardware and software modules of the complete Manipulator Arm system. The concept of the Space Shuttle manipulator system offers exciting potential for future application in other hostile environments, such as the arctic or ocean floor where resource extraction or scientific studies must be carried out.

CAE-designed and built controls operate the remote Manipulator Arm of NASA's Space Shuttle.

Right: *CAE's SIMFAC simulator located in the development and test laboratory of SPAR Aerospace Ltd.*

Far right: *CAE hand-controllers and control panel on the Manipulator Arm control console.*

CAE in Research & Development

Research and development at CAE Electronics Ltd. is a day-to-day activity associated with every project the company undertakes. Prime examples are CAE's continuing research programs in software techniques, state of the art interfacing equipment, Magnetic Anomaly Detection (MAD) systems, simulator visual and motion systems and computer-based training.

Years of research and development in the field of airborne compensation equipment for MAD-equipped aircraft led to the design and production of CAE's automatic compensator, which today is standard on most of the western world's antisubmarine patrol aircraft.

Expertise in the development and application of improved computer technology for flight simulators has generated new, successful product areas for the company, such as: nuclear power station simulators, data acquisition and control systems, air traffic control systems, and complex control systems for application in space.

CAE's senior research and development engineers and scientists, who have many years experience with the company, continue to meet the challenge of product improvement and new product development in today's world of increasingly sophisticated electronic technology.

Far left: *Working with Ontario Hydro engineers, CAE is developing advanced simulation techniques for training nuclear power plant operators.*

Left: *A CAE prototype remote terminal unit undergoing severe electrical noise tests in one of Hydro Quebec's 735 kV switchyards.*

The hand controller shown in this research simulator was developed by CAE for a fly-by-wire helicopter control system and led directly to our involvement in the Space Shuttle.

The G-Seat and G-Suit combination developed by CAE provides realistic, sustained g-force effects in high performance aircraft simulators.

CAE scientists use "eye mark recorders" to accurately measure pilot eye movements in their research into advanced visual system concepts.

CAE
Customer Support

Every system that CAE sells, anywhere in the world, is backed by an extensive customer service organization of skilled field engineers and technicians. More than 60% of the company's equipment is exported, placing strong demands on support services. Over the years, CAE has acquired a reputation for fast response to a customer's request for technical assistance, regardless of the location.

A CAE customer can be sure that support personnel will be on site until the equipment is operating to the customer's satisfaction. Customer support is an important part of CAE's business.

Customer maintenance personnel are thoroughly trained by qualified CAE instructors.

CAE field engineers are available on call, or on contract to assist or to perform customer maintenance.

CAE's logistics staff provides a thorough analysis of customer's spare parts requirements and immediate shipment in emergencies.

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